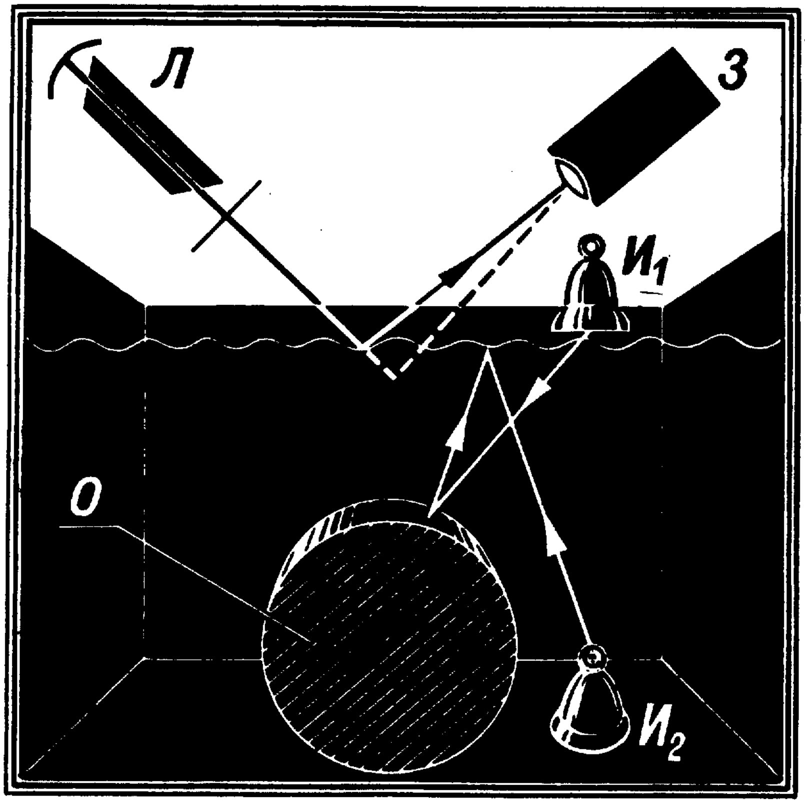
PROJECT	UTILITY ASSESSMENT N-1 X (1987)
TARGET	RUSSIAN DOCUMENT STORED AT THE DIAC.
REASON FOR TARGETING	TO DETERMINE THE REMOTE VIEWER'S ABILITY AND PROPENSITY TO COLLECT FOREIGN INTELLIGENCE INFORMATION AGAINST DOCUMENTS SHIELDED FROM NORMAL PERCEPTION.
TARGETING METHODOLOGY	ENCRYPTED GEOGRAPHICAL COORDINATES.
OPERATIONAL ASSETS	FOUR SOURCES; ELEVEN SESSIONS.

Л. Д. ГИК

АКУСТИЧЕСКАЯ ГОЛОГРАФИЯ



ИЗДАТЕЛЬСТВО · НАУКА ·
СИБИРСКОЕ ОТДЕЛЕНИЕ

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ACOUSTICAL HOLOGRAPHY

L.D. Gik

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Siberian Division

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USSR Academy of Sciences
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dissipation in large-grained ceramics. The dynamic possibilities of SLM based on electro-optic ceramics may be exemplified by a Sandia 256-element page composer operating at speeds up to 10^5 with a contrast ratio 1000:1.

(U) According to Morozov, SLM with individual addressing may be built around paraelectrical memoryless PLZT ceramics with higher optical switching speeds of the order of tens of nanoseconds.

(U) Fast space-time modulators may be built around monocrystalline segnetoelectrics, which are bistable and suitable for SLM with memory. Their mechanism is based on the switching of spontaneous polarization, which is accompanied by essential changes in the optical properties of the crystal. Crystals of bismuth titanate ($Bi_4Ti_3O_{12}$) feature a small switching time of 1 μsec and a half-access voltage of 30 V. Large monocrystals of high optical quality may be obtained from gadolinium molybdate, $Gd_2(MoO_4)_3$, but their switching times are about 0.1-1 msec, which is much greater than those of bismuth titanate.

(U) Morozov states that ferromagnetic materials may be expected to provide a good basis for the design of high-speed SLMs that are matrix addressable by electrical voltage. Their true switching threshold enables the design of devices with over 100 × 100 resolvable elements. There are published reports of SLM designs made of orthoferrites, such as $DyFeO_3$, $YFeO_3$, and $YFe_yGd_xO_3$, $y = 1-x$, that feature the following parameters: 100 × 100 elements; maximal contrast, 400:1; and an optical effectiveness for the red line of a helium-neon laser of over 15%. Writing is done by local magnetic fields generated by current loops, one data bit requiring 10 nsec under a current of 1 A at most and a current loop diameter of 100-300 μm. Erasures and rewriting may be repeated arbitrarily; the storage time is also not limited.

(U) The Soviets hope that new materials and semiconductor injection lasers will enable them to overcome difficulties due to the appreciable absorption of ferromagnetics in the visible spectrum and to the high currents required for magnetic flux reversal.

(U) Space-time light modulators based on multichannel acoustic modulators are also feasible. The light beam is modulated and deflected by means of light diffraction on an acoustic wave excited by piezocrystals. A data array may be generated by means of a great number of individually addressable cells whose number corresponds to the number of modulation channels. The time sequence of m electrical pulses in n channels is transformed by the modulator into a running picture consisting of m-by-n elements.

(U) For parallel reading of a two-dimensional array, the pulse duration of the reading beam should be sufficiently short (about tens of nanoseconds) that a group of successively excited acoustic signals with one carrying frequency can be regarded as a stationary diffraction grid. According to Morozov, an amplitude spatial modulator has been designed with the following characteristics: number of channels $n = 34$, number of elements in each channel $m = 128$, power consumption per channel 0.5 W, and length of elementary acoustic beam 0.127 mm for modulator aperture 33.6 × 21.7 mm^2. Modulator capacity is estimated as 1 Gbps. Multichannel acoustic modulators require powerful pulse sources because the acoustic picture may be regarded as stationary only during a period of several nanoseconds. The major characteristics of some electrically controlled space-time light modulators are tabulated in Table VII.

(U) Electrically controlled SLM input data arrived from the computer memory in electrical form into the optical processing path. Their major task is to quickly generate optical files; i.e., to prepare data for parallel optical systems. Thus, they serve as interfaces between electronic and optical channels of the computer system. As indicated above, their throughput may run into 10^{12} bps and more, but currently existing modulators exhibit a throughput of about 10^9 bps. Data input devices based on lines of memory-less modulators with individual addressing have good speed and may be addressed in one cycle; therefore, a line of 100 elements may have throughput of 10^9 to 10^{10} bps.

3.c. Multipositional Deflectors (U)

(U) These devices are intended for changing laser beam spatial position according to a given law. In holographic memory systems, deflectors are used for random access to memory locations. Deflectors may rely on electro-optic, acousto-optic, magneto-optic, and other physical phenomena.

(U) Electro-optic discrete deflectors are multistep devices, each step consisting of polarizer, electro-optic polarization plane switch, and deflector. The polarizer linearly polarizes radiation. The polarization switch turns by 90 degrees the input beam direction of polarization by subjecting it to an electrical or magnetic field. It may be made of material with a linear electro-optic effect (e.g., crystals of KH_2PO_4, $NH_4H_2PO_4$, $LiNbO_3$, and many others) or a magneto-optic effect ($Y_3Fe_5O_{12}$, $CrBr_3$, etc.). The deflecting element performs spatial or angular separation of light beams with mutually orthogonal polarization.

(U) The basic parameters of discrete electro-optic deflectors are as follows: number of deflection stages,

TABLE VII

(U) BASIC CHARACTERISTICS OF SOME ELECTRICALLY CONTROLLED SLM*

CHARACTERISTICS	SEGNETO-CERAMIC SLM		ACOUSTO-OPTIC SLM		MAGNETO-OPTIC SLM
Modulating medium	PLZT 7/65/35 grain, 2 μm	PLZT 9/65/35 grain, 2 μm	$PbMoO_4$	TeO_2	$YFeO_3$
Modulating effect	Double refraction change	Double refraction change	Refractive index change	Refractive index change	Faraday effect
Addressing	Matrix	Individual	Individual	Individual	Matrix
Working aperture (cm)	3.2 × 3.2	3.0 × 0.5	3.4 × 2.2	8.6 × 75	2 × 2
Supply voltage (V)	100-200	300	—	—	Current 1 A
Complete resolution	128 × 120	128 × 1	34 × 128	100	100 × 100
Element switching time (sec)	—	10^{-7}	5.10^{-6}	10^{-6}	10^{-8}
Array generation time (sec)	—	5.10^{-7}	5.10^{-6}	10^{-6}	10^{-5}
Cycle time (sec)	—	5.10^{-7}	5.10^{-6}	10^{-6}	10^{-5}
Memory	Permanent	No	No	No	Permanent
Maximal contrast	10:1	100:1	—	30:1	350:1
Lifetime	Up to 10^7-10^{10} cycles	10^{11}	Possibly unlimited	Possibly unlimited	Possibly unlimited

*Source: Morozov, p 140.

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number of light beam positions, working length of radiation wave, speed (i.e., time for switching from one resolution element to another), radiation attenuation factor, backlighting in switched-off resolution elements, and half-wave electrical voltage of radiation switching. Discrete deflectors may be both one and two coordinate.

(U) The deflection of light beams by means of acoustic waves is based on the possibility of periodic spatial changing of medium density by means of acoustic waves, thus resulting in periodic spatial variation of the medium refraction coefficient. Acoustic waves form in the medium phase grid with a period equal to the wavelength. When the light beam passes through a medium with a sinusoidally varying refraction coefficient, light diffraction occurs. If the light beam falls at the running acoustic wave under a certain angle, only first-order Bragg diffraction is observed. With alteration of acoustic wave frequency, the direction of the deflected beam changes. Both liquid and solid isotropic and anisotropic materials may be used in Bragg deflectors. TeO_2, $PbMoO_4$, α-HgS, α-HIO_3, Ag_3AsSe_3, and many other materials feature high opto-acoustic effectiveness. The following parameters characterize acousto-optic deflectors: beam deflection angle and resolution, speed, optical effectiveness characterized by the ratio of passed and falling radiation intensities, switching power, central (mean) acoustic wave frequency for which the Bragg condition holds, and the range of control frequency variations supporting light beam scanning.

(U) According to Morozov, there is a practical possibility of building 2-D multipositional deflectors with $\sim 10^4$ positions and switching frequency of up to 10 MHz and more higher, provided they are built of the best materials: $LiNbO_3$ for electro-optic deflectors and α-HIO_3, $PbMoO_4$, and TeO_2 for acousto-optic deflectors.

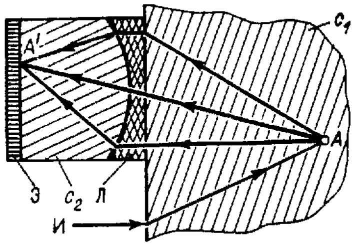
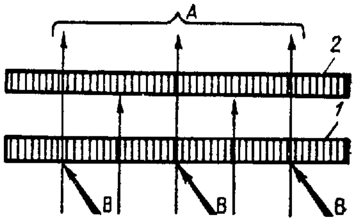


Рис. 33.



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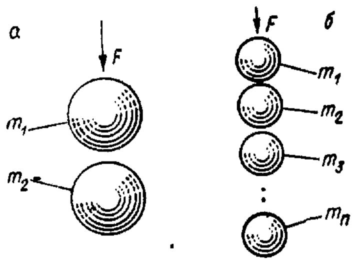

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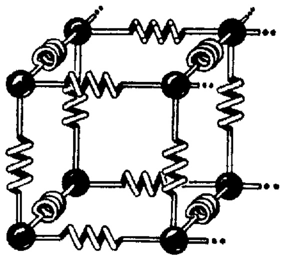

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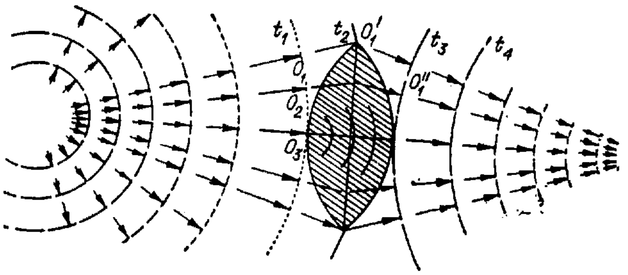

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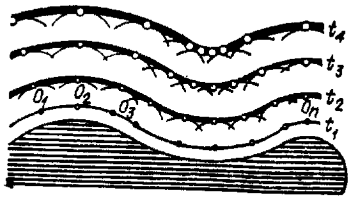

Рис. 3.

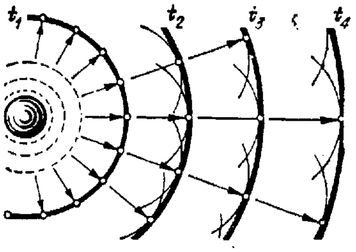

Рис. 4.

REMOTE VIEWER'S PERCEPTIONS

...FIRST SOURCE REPORTED THE TARGET SITE AS BEING LOCATED ON THE UPPER LEVEL, SECOND OR THIRD FLOOR OF AN OFFICE AREA CHARACTERIZED BY THE PRESENCE OF "CUBICLES, DESKS, WORK AREAS" IN A BUILDING LIKE THE DIAC. SOURCE REPORTED THAT THE DOCUMENT DEALT WITH SYMBOLS ASSOCIATED WITH MATHEMATICAL CONCEPTS AND FORMULAS ALONG WITH LISTINGS RELATED TO STRATEGIC ARMS AND TARGETS. THERE APPEARED TO BE TWO DISTINCT PARTS TO THE DOCUMENT. THE FIRST PORTION WAS THEORETICAL IN NATURE WHILE THE SECOND PART PROVIDED MATHEMATICAL JUSTIFICATION IN SUPPORT OF THE THEORY. SOURCE REPORTED CONCEPTS OF CRYSTAL STRUCTURE, USE OF FREQUENCIES, PERCEPTIONS OF VIBRATIONS AND SCATTERING. SOURCE ALSO REPORTED THAT THERE WAS EVIDENCE OF A SURFACE MATERIAL BONDED BY A CRYSTAL STRUCTURE ACTING IN THE MANNER OF A TWO-WAY MIRROR USED TO ABSORB AND SCATTER ENERGY (THROUGHOUT THE MATERIAL) THROUGH THE USE OF "ROD-LIKE INCLUSIONS." A GRAY, SMOOTH, SHINY, LONG, ROUND, METALLIC, CYLINDRICAL OBJECT IS FUNCTIONALLY ASSOCIATED WITH THE THEORY ESPOUSED BY THE DOCUMENT.

...SECOND SOURCE REPORTED THE TARGET SITE AS A DARK, GLASSY, CURVY, MODERN-APPEARING STRUCTURE LOCATED IN A SETTING OF LOW ROLLING HILLS WITH FENCES AND PARKING AREAS. THE FIRST AREA INSIDE THE STRUCTURE WAS A RECEPTION AREA WHICH HAD LONG HALLWAYS, HIGH CEILINGS, AND WHICH DISPLAYED HISTORICAL, REPRESENTATIONAL PAINTINGS. THE DOCUMENT WAS MAINTAINED IN A SECOND AREA WHICH WAS CHARACTERIZED BY MUCH LOWER CEILINGS. THE WORK IN THIS SECOND AREA WAS OF A SCIENTIFIC NATURE AND THE DOCUMENT IS STORED HERE. SOURCE REPORTED SMALL CIRCLES AND BLACK PRINT ON THE COVER OF THE DOCUMENT. SOURCE REPORTED THAT THE DOCUMENT DEALT WITH SUCH CONCEPTS AS ENERGY AND PHASES OF IMPLEMENTATION. SOURCE ALSO REPORTED THAT THE DOCUMENT IS DIRECTLY RELATED TO THE CAPTURE AND STORAGE OF "LIGHT AND ENERGY" IN VERY SMALL CUBES (CRYSTALS). TWO PRINCIPLES APPEARED TO BE INVOLVED; THE FIRST WAS DESCRIBED AS AN "EYE TO EYE PRINCIPLE" AND THE SECOND WAS DESCRIBED AS THAT OF TRANSPARENCY WITH A "REVERSING" EFFECT.

...THIRD SOURCE REPORTED THE TARGET SITE AS A LARGE, FLAT-SIDED BUILDING WITH A PREDOMINANCE OF STRUCTURES THAT WERE SQUARE, RECTANGULAR, AND BROWNISH-GREEN IN APPEARANCE. THE STRUCTURE WAS PERCEIVED AS A GOVERNMENT BUILDING WITH ESTABLISHED VISITOR CONTROL POINTS. SOURCE REPORTED THAT THE SETTING REMINDS ONE OF THE DIAC. SOURCE REPORTED THAT THE LETTERS ON THE DOCUMENT WERE L, I, N, AND E. THE SUBJECT MATTER DEALT WITH TECHNICAL ASPECTS OF WEAPONRY AND DESIGN CAPABILITIES. THE DOCUMENT WAS A SYNTHESIS OF DATA COMPLIED FROM VARIOUS OUTSIDE SOURCES. THE DOCUMENT OUTLINED ASSETS, QUANTITIES, LIMITS, AND PURPOSES.

...FOURTH SOURCE REPORTED THE TARGET SITE AS A LARGE, "WALLED-IN" BUILDING RESEMBLING AN ART GALLERY REPLETE WITH DRAWINGS AND PICTURES ON A WALL. WELL-DRESSED PERSONS WERE OBSERVED MILLING ABOUT AND FURNITURE WAS LOCATED IN THE MIDDLE OF THE ROOM. SOURCE REPORTED THAT THE DOCUMENT DEALT WITH THE PRESENCE OF A BLACK, MICROSCOPIC CRYSTAL-FORMED MATERIAL THAT WAS GREASY TO THE TOUCH.

ANALYTICAL COMMENTS

...THE DOCUMENT HAS SYMBOLS ASSOCIATED WITH MATHEMATICAL CONCEPTS AND FORMULAS AND THE VIEWER'S PERCEPTIONS ARE CONSISTENT WITH SUBSTANTIAL CONTENT OF DOCUMENT. THE DOCUMENT ADDRESSES CRYSTALLINE VIBRATIONS AND SCATTERING AS REPORTED BY SOURCE. THE CRYSTAL MODEL SHOWN IN THE TEXT ILLUSTRATES CRYSTALLINE VIBRATION VIA THE USE OF "ELASTIC" SPRING CONNECTIONS AND SOURCE WAS CORRECT WHEN REPORTING THAT THERE IS EVIDENCE OF SURFACE MATERIAL BONDED BY A CRYSTAL STRUCTURE ACTING IN THE MANNER OF A TWO WAY MIRROR USED TO ABSORB AND SCATTER ENERGY THROUGH THE USE OF ROD-LIKE INCLUSIONS. IN VIEW OF THE HOLOGRAPHIC PRINCIPLE, SOURCE WAS ESSENTIALLY CORRECT

WHEN IT WAS REPORTED THAT THE DOCUMENT DEALS WITH THE CAPTURE AND STORAGE OF LIGHT AND ENERGY IN VERY SMALL CUBES. HOWEVER, SOURCE REPORTED AN APT DESCRIPTION OF THE HOLOGRAPHIC PROCESS ADDRESSED BY THE DOCUMENT WHEN IT WAS REPORTED THAT THE DOCUMENT ADDRESSED THE TECHNICAL CONCEPT DESCRIBED AS AN "EYE TO EYE" PRINCIPLE AND "TRANSPARENCIES" WITH "REVERSING" EFFECTS. THE DOCUMENT WAS STORED IN THE 6TH FLOOR OF THE DIAC AND ALL VIEWER'S CORRECTLY IDENTIFIED THE DIAC.

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